Madera Ranch Groundwater Bank

Information Packet for Integration Panel

Bureau of Reclamation
Department of the Interior
August 24, 1998

Information Package for Madera Ranch Groundwater Bank

Purpose

This information package was assembled from existing data in support of a meeting of the Integration Panel to consider funding from the Environmental Water Acquisition Program. This package includes the following information:

- Attachment 1- The overall cost estimates for the project (land acquisition, infrastructure, operations) .
- Attachment 2 - Proposed operations (Who would operate, what year types will water be diverted and made available for diversion, water sources, priorities).
- Attachment 3 - Biological benefits and impacts.

Also enclosed is a copy of the May 1998 Phase 1 report on Reclamation's evaluation of Heber Perrett's proposal to construct and operate a groundwater bank on his Madera Ranch.

Attachment 1

Madera Ranch Groundwater Banking Project

Cost Estimate for Groundwater Banking at Madera Ranch

Pumping Capacity	200 cfs	
Capital Cost ($)	91,268,750	
Land Acquisition	25,000,000	/1
Construction Cost	60,000,000	/2
Interest During Construction	6,268,750	
Annual Capital Cost @7.375% ($)	6,928,532	
Annual O&M Cost ($)	400,000	
Annual Capital and O&M Cost	7,328,532	
Average Annual Yield (AF)	70,000	
Annual Capital and O&M Cost/AF ($/AF)	105	
Total Pumping Cost/AF ($/AF)	9	/3
Pumping Cost from Mendota Pool/AF	2	
Pumping Cost from Underground/AF	7	
Annual Total Cost/AF ($/AF)	114	

/1 Assumes $50 Million total land acquisition cost with $ 25 Million allocated to endangered species habitat and $25 million allocated to the water bank.

/2 Based on estimates from Bookman- Edmonston Engineering.

/3 Assumes CVP power @ 35 mills per kilowatt-hr.

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Attachment 2

Madera Ranch Groundwater Bank Operations

The proposed Madera Ranch groundwater bank would provide storage for a water reserve account that would assist Interior in meeting the requirements under Public Law 102-575 Title XXXIV (CVPIA). Requirements dedicating 800,000 acre feet to enhance fish and wildlife and associated habitats are described in Section 3406 (b) (2), and detailed in the final *Administrative Proposal on the Management of Section 3406 (b)(2) Water*, released November 20, 1997.

Interior proposes creating a Water Reserve Account for environmental, agricultural, and urban uses. In the long-term (beyond 2000), the Water Reserve Account would be banked in the Madera Ranch Groundwater Banking Project.

Reclamation would be responsible for water operations at the groundwater bank. Water to be stored at the water bank would be spills on the San Joaquin and Kings Rivers and CVP water pumped from the Delta. Water for storage would be diverted at the Mendota Pool and transported by a two way delivery canal to the recharge facility on the Madera Ranch. Water would be returned to the Mendota Pool, when needed, by pumping from the recharged aquifer for delivery back to the Mendota Pool. Water returned to the Mendota Pool would be diverted for agricultural irrigation or refuge water needs. Other users of the water bank would participate by exchanges with Mendota Pool diverters. Instream flows in the San Joaquin River below Mendota Pool could also be supplemented by deliveries from the water bank.

Operational rules would be developed to protect adjacent landowners from adverse impacts to the aquifer. The operational rules would define the conditions for recharge operations to avoid damage from high water levels, and water bank pumping restrictions to protect private wells adjacent to the project.

The operations of the proposed water banks were modeled using a spreadsheet model with the following assumptions:

1. 400 cfs channel capacity from Mendota Pool to Madera Ranch (24 taf/month)
2. 3,500 acre infiltration area, with a surface storage depth of 6 feet (21 taf)
3. 0.2 acre-feet/acre/day infiltration rate (21 taf/month)
4. 0.1 specific yield of the aquifer
5. 50 ft/day hydraulic conductivity of the aquifer.
6. 208 cfs maximum extraction rate (12.5 taf/month).

Other Assumptions:

1. The source of infiltration water is spill water from Friant and Kings River north and releases from the Delta Mendota Canal originating in the Delta.
2. 15% loss of Friant Dam spill water to the groundwater basin between Gravelly Ford and Mendota Pool.
3. The basic demand pattern is a combination of the agricultural pattern for demands from March through September and Refuge water demands for October and November.

A summary of the modeling results that were used in the May 1998 "Madera Ranch Groundwater Bank Phase 1 Report" is attached.

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Madera Ranch

Capacities (Assuming separate channels for Kings and SJR)

		TAF/Month
Percolation Area (acres)		3500.0
Surface Storage (TAF)		21.0
Under Ground Storage (TAF)		390.0
Mendota Pool Canal (enter cfs)	400	24.1
SJR Canal above Bypass (enter cfs)	0	0.0
SJR Channel bl ByPass (enter cfs)	2500	150.8
Percolation Rate (enter inches/day)	2.4	21.3
Pump Capacity (Gal/Min)		824.0
Number of Pumps		113.0
Total Capacity (TAF/Mo)		12.5

Demands: Ag and Refuge pattern

Demand in TAF/Month

Yr Types>	1	2	3	4	5
Oct	12.5	12.5	12.5	12.5	12.5
Nov	12.5	12.5	12.5	12.5	12.5
Dec	0.0	0.0	0.0	0.0	0.0
Jan	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.0	0.0	0.0	0.0
Mar	0.0	0.0	12.5	12.5	12.5
Apr	0.0	0.0	12.5	12.5	12.5
May	0.0	0.0	12.5	12.5	12.5
Jun	0.0	0.0	12.5	12.5	12.5
Jul	0.0	0.0	12.5	12.5	12.5
Aug	12.5	12.5	12.5	12.5	12.5
Sep	12.5	12.5	12.5	12.5	12.5
Total	50	50	112.5	112.5	112.5
Reserved GW	0 TAF		Year Types 1 through 4		

Supply

Kings Supply:	Flood control releases from Pine Flats diverted at Cresent Weir through Fresno Slough
SJ River:	Friant flood control releases with losses between Gravelly Ford and Mendota Pool
DMC Supply:	Put 25,000 acre-ft in Dec, Jan, and Feb unless flood control release water avail.

Average Annual Yield (TAF)

70 Year Period	70.9
Worst 20 Years	51.2
Best 20 Years	75.0

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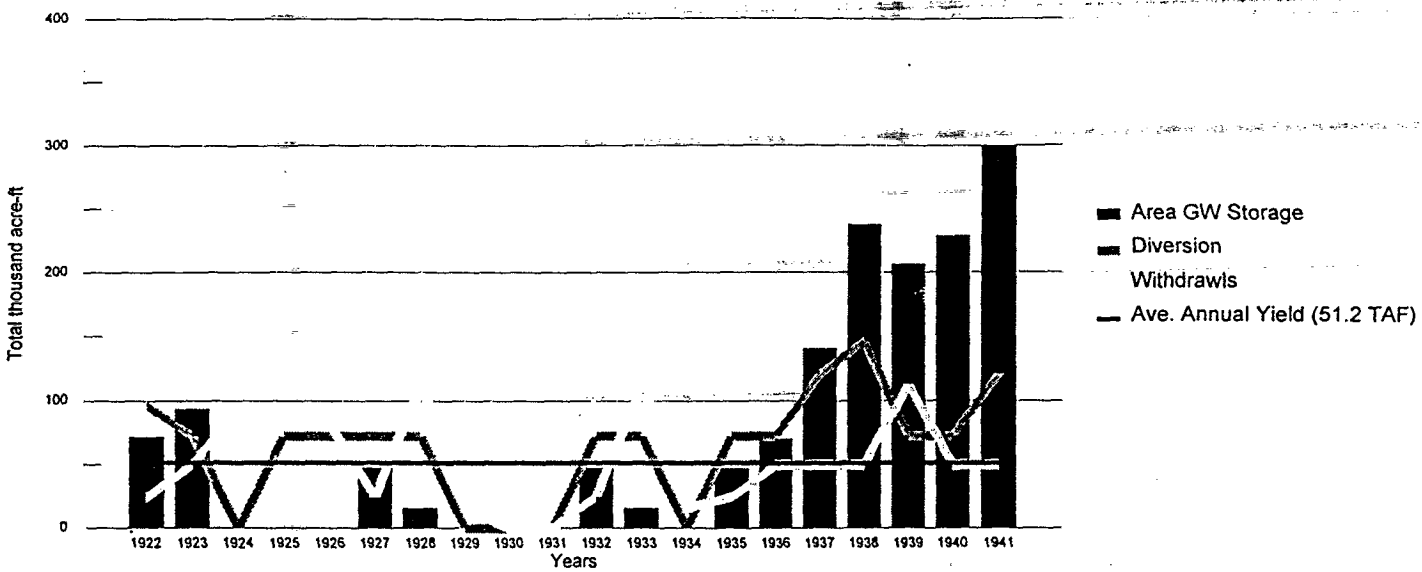
Annual Madera Ranch Operation

Water Year	Kings Supply (TAF)	SJR Supply (TAF)	DMC Supply (TAF)	Mend Supply (TAF)	Ranch Surf Storage (EOYTAF)	Area GW Storage (EOYTAF)	Deep Perc (TAF)	SJR Divs (TAF)	Mend Divs (TAF)	Demand (TAF)	WthDrwls (TAF)	Year Type
1922	0	80	75	143	0	72	97	0	97	50	25	1
1923	7	0	68	75	0	94	72	0	72	50	50	2
1924	0	0	0	0	0	0	0	0	0	113	94	5
1925	0	0	75	75	0	0	72	0	72	113	81	3
1926	0	0	75	75	0	0	72	0	72	113	81	4
1927	0	0	75	75	0	47	72	0	72	50	25	2
1928	0	0	75	75	0	16	72	0	72	113	113	3
1929	0	0	0	0	0	0	0	0	0	113	16	5
1930	0	0	0	0	0	0	0	0	0	113	0	5
1931	0	0	0	0	0	0	0	0	0	113	0	5
1932	0	0	75	75	0	47	72	0	72	50	25	2
1933	0	0	75	75	0	16	72	0	72	113	113	4
1934	0	0	0	0	0	0	0	0	0	113	16	5
1935	0	0	75	75	0	47	72	0	72	50	25	2
1936	0	3	75	78	0	70	72	0	72	50	50	2
1937	62	270	25	316	0	140	121	0	121	50	50	1
1938	365	1362	0	1107	0	238	133	0	146	50	50	1
1939	0	0	75	75	0	206	72	0	72	113	113	4
1940	0	0	75	75	0	229	72	0	72	50	50	2
1941	16	252	47	277	0	299	121	0	121	50	50	1
1942	16	11	47	72	0	314	65	0	71	50	50	1
1943	32	226	50	274	0	385	101	0	121	50	50	1
1944	0	0	75	75	0	324	30	0	51	113	113	3
1945	0	11	64	73	0	345	72	0	72	50	50	2
1946	0	0	75	75	0	368	70	0	72	50	50	2
1947	0	0	75	75	0	324	47	0	68	113	113	4
1948	0	0	75	75	0	292	72	0	72	113	113	3
1949	0	0	75	75	0	260	72	0	72	113	113	3
1950	0	0	75	75	0	229	72	0	72	113	113	3
1951	66	208	0	243	0	227	48	0	48	50	50	2
1952	89	499	75	404	0	322	145	0	145	50	50	1
1953	0	0	75	75	0	290	72	0	72	113	113	3
1954	0	0	75	75	0	259	72	0	72	113	113	3
1955	0	0	75	75	0	227	72	0	72	113	113	4
1956	109	455	0	446	0	295	118	0	118	50	50	1
1957	0	0	75	75	0	263	72	0	72	113	113	3
1958	0	277	75	310	0	334	121	0	121	50	50	1
1959	0	0	75	75	0	303	72	0	72	113	113	4
1960	0	0	0	0	0	190	0	0	0	113	113	5
1961	0	0	0	0	0	78	0	0	0	113	113	5
1962	0	0	75	75	0	46	72	0	72	113	113	3
1963	0	0	75	75	0	68	72	0	72	50	50	2
1964	0	0	75	75	0	37	72	0	72	113	113	4
1965	0	8	67	74	0	59	72	0	72	50	50	1
1966	0	0	75	75	0	27	72	0	72	113	113	3
1967	109	761	75	647	0	158	169	0	169	50	50	1
1968	4	0	75	79	0	130	76	0	76	113	113	4
1969	845	1644	25	1704	0	259	165	0	178	50	50	1
1970	96	82	25	191	0	274	65	0	67	50	50	2
1971	0	0	75	75	0	242	72	0	72	113	113	3
1972	0	0	75	75	0	210	72	0	72	113	113	4
1973	0	0	75	75	0	233	72	0	72	50	50	2
1974	0	45	50	88	0	255	72	0	72	50	50	1
1975	0	0	75	75	0	278	72	0	72	50	50	1
1976	0	0	0	0	0	165	0	0	0	113	113	5
1977	0	0	0	0	0	53	0	0	0	113	113	5
1978	245	1005	75	772	0	147	145	0	145	50	50	1
1979	0	3	72	75	0	170	72	0	72	50	50	2
1980	297	636	25	835	0	265	145	0	145	50	50	1
1981	0	0	75	75	0	233	72	0	72	113	113	4
1982	177	715	51	592	0	325	142	0	142	50	50	1
1983	1626	2442	0	2796	20	386	90	0	138	50	50	1
1984	457	490	0	853	0	386	4	0	42	50	50	2
1985	0	0	75	75	0	324	29	0	50	113	113	4
1986	312	1019	50	977	0	386	92	0	113	50	50	1
1987	0	0	0	0	0	274	0	0	0	113	113	5
1988	0	0	0	0	0	161	0	0	0	113	113	5
1989	0	0	0	0	0	49	0	0	0	113	113	5
1990	0	0	0	0	0	0	0	0	0	113	49	5
1991	0	0	0	0	0	0	0	0	0	113	0	5
1992	0	0	0	0	0	0	0	0	0	113	0	5
	69	176	48	222			66	0.0	68.7	83	71	
'22-'41	22.5	98.3	48.3	133.6			63.4	0.0	64.0	81.3	51.2	
'68-'87	203.0	404.1	965.0	470.6			72.9	0.0	80.1	75.0	75.0	
'69-'90	184	367	37	424			63	0.0	69.3	78	76	
'69-'92	169	337	34	389			58	0.0	63.6	81	69	

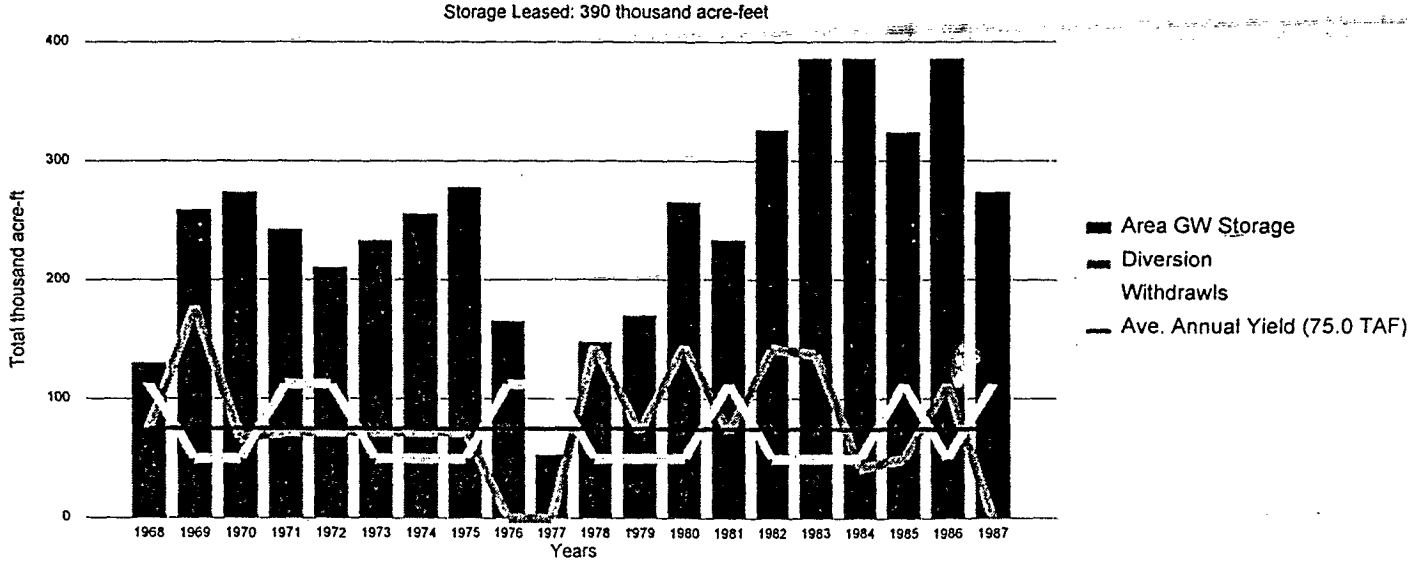
Madera Ranch Groundwater Bank: Worst 20 Years

Storage Leased: 390 thousand acre-feet



Madera Ranch Groundwater Bank: Best 20 Years

Storage Leased: 390 thousand acre-feet



Attachment 3

Biological Benefits and Impacts

The detailed investigation of biological benefits and impacts will occur during the next phase of the decision process leading to implementation of the groundwater bank. The project would be implemented and operated to minimize adverse impacts and provide benefits to both aquatic and terrestrial species.

Aquatic species would benefit from the water stored in the groundwater bank for use in supplementing dry and critically dry year environmental water supplies. This supplemental water would be used in refuges, to improve instream flow , and to supplement water supplies for agriculture and municipal uses.

Terrestrial species, including special status species, on the Madera Ranch would benefit from habitat protection and enhancement activities with removal from private ownership and subsequent intensive agricultural development. The Madera Ranch includes approximately 13,600 acres with 3000 acres currently under cultivation.

Temporary impacts to terrestrial species will occur during construction of the supply canal, recharge ponds and retrieval wells. Construction of the recharge ponds will permanently convert up to 3500 acres from irrigated agriculture and undeveloped pasture to intermittently flooded land.

The potential for wetland development associated with construction of the recharge ponds will be investigated.